Heliomeris nevadensis (*Gymnolomia nevadensis* Nelson, 1904).
Heliomeris brevifolia (*Gymnolomia brevifolia* Greene, 1913).
Heliomeris longifolia (*Gymnolomia longifolia* Rob. & Greenm., 1899).
Heliomeris annua (*Gymnolomia multiflora annua* Jones, 1895).
Heliomeris hispida (*H. multiflora hispida* Gray, 1853).
Heliomeris hispida ciliata (*Gymnolomia hispida* var. *ciliata* Rob. & Greenm. 1899).
Heliomeris porteri (*Rudbeckia porteri* Gray; *Gymnolomia porteri* Gray).
Heliomeris obscura (*Gymnolomia obscura* Blake, 1916).
Arnica monocephala Rydb. becomes *A. pedunculata* Rydb. f. *monocephala*.

Boulder, Colorado.

THE HAWAIIAN SUMACH

Neneleau; *Rhus semialata* var. *sandwicensis* Engler

By Vaughan MacCaughey

In 1917 the author published an annotated list of the forest trees of the Hawaiian Archipelago, in the Bulletin of the Torrey Botanical Club (44: 145–157). In the Botanical Gazette (64: 89–114, Aug. 1917) he described in detail the unparalleled endemism of the Hawaiian flora, especially the arborescent flora, The present paper deals with an endemic tree, the Hawaiian sumach, the sole native representative of a large and important tropical family. At present there is no detailed account of this tree in the literature. The Hawaiian sumach is a small tree,

white patches on the rays is fading, but these are irregular. In the palest forms of *Helianthus annuus* obtained by my wife in her cultures, the rays are at first light yellow throughout, but at full maturity are pale yellowish basally, shading into white apically; but the transition is not abrupt as in the *Heliomeris*.

The insect-visitors of *H. multiflora* were noted, and consisted of the following bees: *Bombus bifarius* Cresson, *Panurginus parteræ* Ckll., *Halictoides cryx* Vier., *Halictus cressoni* Rob., and the honey-bee; also the fly *Eristalis latifrons* Lev., and the plant-bug *Ligyrocaris contractus* Say. *Phacelia* and *Monarda* at the same place were visited by almost entirely different sexes of bees, belonging to other genera in the main: e.g. *Anthophora* on *Monarda*, *Osmia* and *Anthidium* on *Phacelia*

fairly common here and there throughout the lowlands, and resembling in its general characters the familiar sumachs of the continental United States. Its most remarkable feature is its geographical distribution, which affords one more clue to the primitive floral connections of Hawaii with southwestern Asia. The semi-alate sumach extends from the mountains of the Himalayas to the mountains of Hawaii.

The sumach family, Anacardiaceae, comprises 58 genera and about 420 species. It is mostly tropical, with Malaya as the largest center of distribution. There are a few extra-tropical genera, of which *Rhus* is typical. The family is represented in Hawaii by a single endemic variety and seven or more introduced species. The latter include the mango tree; the wi, *Spondias dulcis;* the Tahiti apple, *Spondias lutea;* the cashew nut, *Anacardium occidentale; Semecarpus anacardium;* the pepper tree, *Schinus molle;* and the Christmas-berry tree, *Schinus terebinifolius.*

Rhus is the largest genus of the family and includes 120 species and subspecies. It is most abundant in South Africa, but also occurs throughout the world. Several species are native to the Fiji and the Society Islands. The Japanese sumach, *Rhus vernix*, has been introduced recently into Hawaii. The foliage and bark of most species are rich in tannin and are used for tanning leather. Certain oriental species yield lacquer and vegetable wax. Hawaii is extremely fortunate in having no poisonous rhuses in her flora; poison ivy is unknown. It is noteworthy that there are no plants in the Hawaiian flora that are poisonous to the touch.

The Hawaiian sumach is *Rhus semialata* Murray var *sandwicensis* Engler. The species is a small tree, indigenous to the Himalaya Mountains, at 3,000–6,000 ft. The variety, which is endemic to the Hawaiian group, differs from the species only in having the rachis of the leaf *not* winged. The species is not known in the other islands of Polynesia. A query may be raised as to whether the uniformly wingless condition of the Hawaiian variety is of varietal or specific status. It is difficult to explain the presence of this tree in the Hawaiian islands. The primitive Hawaiians knew it by the name of *nenleau* or *neleau.*

They are not known to have had any special uses for the tree, and beyond question did not introduce it from the South Pacific, as they did many other useful Polynesian plants. It has probably occupied the Hawaiian Islands since very remote times, in which the topography of the Central Pacific was very different from that of the present era. There may have been *extensive land-connections with Asia;* there is much biological evidence to support this hypothesis.

The tree is small and flat-crowned, 6–25 ft. high. It is often a tall shrub, with one or more trunks and a few bold, wide-spreading branches. It is a rapid grower, under favorable conditions. The terminal twigs are often 40–60 cm. long. The roots are fleshy. Like many other species of *Rhus* it often sends up numerous shoots from the roots, and forms dense clumps. In early times, before the lowlands were invaded with foreign vegetation, these clumps were much more extensive and numerous than at present. The branches are so pithy and brittle that they are often more or less mutilated. The crown usually contains man often more or less mutilated. The crown usually contains many dead branches and twigs.

The trunk is 20–35 cm. in diameter, and smooth-barked. The sap is milky, viscid, and resinous. The pith becomes pale brown. The wood is soft, very light in weight, tough, yellowish gray in color, with darker streaks. The sapwood is lighter than the heartwood. The grain is rather coarse, but the wood takes a smooth polish. It was formerly used by the planters for ox-plows. It weighs about 27 lbs. per cu. ft. Its specific gravity is about .43. The pith rays are fine and inconspicuous. The ducts are scattered through the seasonal rings, *i. e.*, diffuse porous.

The twigs are stout, pithy, and brittle. They stand out at angles of 30–90 from the branches. They are leafy at the tips and bare below. They are covered throughout with thin, smooth, brown bark. The younger twigs are often tunneled by borers and ants. The lenticels are numerous, large, corky, prominent, and lighter brown than the bark. The petiole scars are large, prominent, heart-shaped, with prominent bundle scars. The

petiole scars are persistent and show plainly on the old branches. On the older branches the bark becomes purplish brown. The lenticels break into large, light-colored stripes, which form a showy color pattern against the darker bark. The ends of the branches are covered with rusty brown wool. The leaves tend to form terminal masses or rosettes on the branches. The individual leaves stand nearly at right angles to the twigs.

The terminal buds are 4–8 mm. long, cylindric, blunt, naked, and consisting of one leaf rudiment much larger than the other leaf rudiments which are clustered at its base. All parts are densely covered with fine brown tomentum. The leaf segments of the rudiments are folded conduplicately.

All parts of the young leaves, especially the petiole, midrib and undersurface are strongly suffused with red. The half-matured leaves have bright red petioles and midrib, the blade is vivid green. The leaflets are roughish pubescent above and covered below with fine whitish wool.

The leaves are alternate, evergreen. The mature leaves are 24–36 cm. long and 20–24 cm. wide, obovate, compound, impari-pinnate, with 2–6 (usually 5–6) pairs of petioled leaflets and 1 terminal leaflet. The top-most pair of leaflets are longest; the terminal leaflet is the largest.

The midrib is 10–30 cm. long, terete, not margined, petiolate in the lower third or fourth. The petiole is terete, stout, angled and much enlarged at its base, and conspicuously excavated above, making a pocket for the axillary bud. The basal part of the petiole is a motile region or pulvinus, for the proper orientation of the blade. There are no stipules. The leaflets are crowded so as to overlap. They are ovate-lanceolate or oblong, with apex more or less acute, base rounded or broadly cuneate, and margin coarsely crenate serrate. They are 5–15 cm. long and 2.5–8 cm. wide, tough, semi-coriaceous, almost sessile or short stalked. The venation is pinnate; the veins are prominent below, and impressed above. The midrib of the leaflet is strong, sometimes lighter and sometimes darker than the blade. The lateral veins are numerous, parallel, and boldly forking toward their extremities. The leaflets are subglabrous above

and downy underneath. The old leaves are more or less marked with yellow, especially around the margins of the leaflets. They finally change to a bright rich sumach red, against which the main veins remain vivid green.

The Hawaiian sumach is very showy when in flower. The flowers are polygamous; in most species of *Rhus* they are dioecious by abortion. They are small, yellowish or creamy white. They are arranged in panicles which are very large, dense, terminal, compound, and broad, 30 cm. long, and many-flowered. The calyx is deeply 5-lobed, imbricate, 1 mm. diam., tomentose, persistent. The disk surrounding the base of the free ovary is coherent with the base of the calyx. The petals are 5, 2 mm. long, longer than the calyx, imbricate, obovate, glabrous or ciliate, inserted under the margin of the disk, opposite its lobes, and deciduous.

The stamens are 5, inserted on the margin of the disk, alternate with the petals. Filaments subulate, very short; anthers ovate, obtuse, often small or abortive in the female flowers, introrse, 2-celled, attached by the back and longitudinally dehiscent.

The ovary is ovate or subglobose, sessile. Styles 2–3, short, terminal or sometimes united; stigmas capitate. Ovule solitary, anatropous, suspended from an erect funiculus which rises from the base of the ovary. Fruit a small dry drupe, ovoid, globose, or compressed, and 3–4 mm. diam. The outer coat is thin, dry, and tomentose. The pulp is more or less resinous, similar to the Japanese commercial wax. The stone is crustaceous or bony, and thin. The seed is ovate or reniform, commonly transverse, without albumen; cotyledons foliaceous, generally transverse; radicle long, uncinate, laterally accumbent. The fruits of the species are used by the Himalayan hill folk as a remedy for colic. The old fruit clusters are persistent, dry, compact, and with reflexed branchlets, on naked twigs. They are 10–15 cm. long and 6–10 cm. wide.

The Hawaiian sumach occurs on all the larger islands of the archipelago at elevations of 600–2,000 ft., throughout the lowland and lower forest zones, in both dry and wet situations. It grows in more or less isolated clumps, and never forms pure

stands. It is intolerant of shade, and is not able to withstand the competition of such forms as the introduced guava, lantana, etc. It is not distinctively a tree of dry and barren soil, as are so many mainland species of *Rhus*. Typical stations are: *Kauai*, Makaweli, Waimea; *Oahu*, Nuuanu, Heeia, Kahuku, Kaena; *Maui*, Kaupo, Hana, Haiku; *Hawaii*, Hilo, Kau, North Kona. It has suffered greatly from the ravages of cattle, goats, sheep, and such foreign pests as Hilo grass and guava.

HONOLULU

CHARLES KEENE DODGE

BY KENNETH K. MACKENZIE

CHARLES KEENE DODGE, whose death took place on March 22, 1918, was one who took the keenest delight in the study of systematic botany and in the life of observation which goes with it. He was a true botanist and lover of nature and one who had nothing in common with the hosts of chemists and physicists who have invaded the domains of botany and whose papers make the botanical magazines unreadable to those really interested in living plants and their relationships.

Born on April 26, 1844, in the township of Blackman, Jackson County, Mich., on a farm five miles north of the city of Jackson, Mich., he lived in Michigan all his life with the exception of some two years spent in the west and in the south; and he was buried in his native State at Lakeside Cemetery, Port Huron.

His education was received in the country and city schools of Michigan. In 1865–1866, he attended the Union School at Ann Arbor. After graduating, he entered the University of Michigan in the fall of 1866, where he pursued a classical course. His graduation took place in 1870.

After graduating, Mr. Dodge taught school in Rockland, Mich., for two years and also at Hancock, Mich., for two years. During this time he took up the study of the law and in 1875 he was admitted to the bar at Port Huron, Mich.

Mr. Dodge continued to reside in Port Huron, Mich., from 1875 until his death, with the exception, as before stated, of